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TAB E

GUIDELINES FOR USE OF NEW JERSEY LIGHT TRAPS FOR MOSQUITO SURVEILLANCE

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The New Jersey Light Trap is an important tool for adult mosquito surveillance. Because of differences that occur in the behavior of individual species it is important to recognize that there are factors that influence the reliability of the light trap for adult mosquito surveillance.

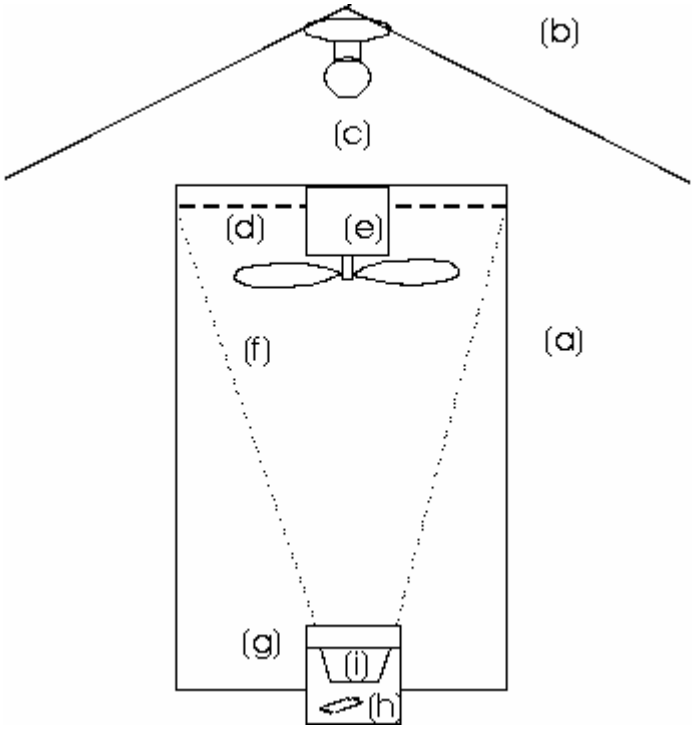
To perform and evaluate an effective mosquito control program in any area, it is critical to know the abundance and species composition of mosquitoes in that area. The New Jersey Light Trap is one of the most commonly used tools for obtaining this information.

The New Jersey Light Trap has been used by Mosquito Control Agencies since 1934, as a device for obtaining information for mosquito research and for planning the operation of mosquito control activities. The trap is a simple and practical tool for obtaining data on adult mosquito populations without the variability and costs associated with human collectors.

History of the New Jersey Light Trap: The first light trap was developed in 1927 at the New Jersey Agricultural Experiment Station and was called the "Sugar Can Trap" because of the container that was used in the design. It was reported that the trap was capable of collecting as many mosquitoes between dusk and dawn as a human could in a fifteen-minute period.

The original trap did not use a fan, but used the "Air Blast Trap" that was developed in 1930. It included a light and fan mounted in a horizontal tube that rotated in response to wind. In the latter part of 1932, the trap was redesigned to be mounted vertically and was designated as the "Model 50 Light Trap". This trap became the standard light trap used in New Jersey and later became known as the "New Jersey Light Trap".

Description of the New Jersey Light Trap: One of the major points in favor of the New Jersey Light Trap is its simplicity and ease of operation. The trap (Fig. 1) consists of a vertical metal cylinder (a) that is 9 inches in diameter with a 16-inch diameter conical roof (b) that is fitted above the cylinder top. Please see the figure below for description of components of a New Jersey Light Trap. At the apex on the underside of the roof, a socket (c) is provided for a 25-watt light bulb that attracts the mosquitoes to the trap. The entrance to the cylinder is covered with a 1/4 or 5/16 inch mesh screen, (d) to exclude larger insects such as moths and beetles. Within the cylinder, an 8-inch diameter fan (e), run by an electric motor, sucks in mosquitoes that fly close to the light. Below the fan is a fine mesh funnel (f) that leads to the collection jar (g). A killing agent (h), such as a piece of vapona strip is placed within the collection jar. A ventilated paper or plastic cup (i) is placed within the collection jar to separate the insects from the killing agent. The traps are normally run on household current, although they can be modified to run on battery. In most cases, the trap is turned on by an electric eye or timer just before dusk and turned off shortly after dawn. Timers need to be checked daily to make sure that there was no power failure during the night, and when the time change occurs.



Uses of the New Jersey Light Trap: There are two primary functions that the New Jersey Light Trap performs in mosquito surveillance programs. One is to provide a historical record of mosquito abundance and species presence in an area. Historical data show fluctuations on a year-to-year basis as well as fluctuations over the span of one season. This type of information can be used to document the impact of mosquito control activities and provide the justification for additional control efforts in an area.

The second function of the New Jersey Light Trap in mosquito surveillance programs is to provide rapid information on mosquito abundance and species composition for planning and directing day-to-day mosquito control activities. In this function, the data acquired by the New Jersey Light Trap are used to 1) determine or to help the need, the timing, and/or the location of pesticide applications, and to monitor the results of those pesticide applications, 2) to help determine the cause of repeated mosquito complaints in a given area, and 3) as a supplement or backup to more expedient surveillance techniques such as landing or bite counts. Landing or bite counts should be done to determine when to spray for the target pests.

Factors Influencing Light Trap Reliability and Variability: The New Jersey Light Trap can be an effective tool for managing mosquito populations, but mosquito species vary in their response to artificial light, climatic conditions, and other natural stimuli. As a result, a great deal of variability is possible in the attraction of mosquitoes to light traps and the accuracy of data resulting from light trap collections.

The two most important sources of variation in light trap collections include nightly variation and variation resulting from trap placement. Nightly variation results in considerable differences in the numbers of mosquitoes captured from night to night due to environmental factors (temperature, relative humidity, and the lunar cycle) that influence mosquito behavior.

Moonlight affects both the efficiency of the light trap and the behavior of the mosquitoes that are being sampled. The brightness of the moon affects the contrast of the trap's light source in relation to the background light that the insect is navigating in which in turn affects the attractiveness of the trap to the mosquito. Although it is generally accepted that fewer mosquitoes are caught at full moon than with a new moon, some species' flight activity increases substantially on bright versus moonless nights.

Compounding the variability resulting from moonlight, the affects of temperature and humidity on mosquito activity and light trap collections are well documented. There are varying ranges of temperature and humidity at which individual species are most active. For example, *Aedes vexans* activity intensifies as the relative humidity increases to 70%. With higher relative humidity, this mosquito shows a decline in activity. The amount of variability of humidity, temperature, and moonlight throughout the night will affect the numbers of mosquitoes collected in a trap from night to night.

Placement variations refer to the variability of light trap collection due to the location of the trap. The variability factors of location include proximity to a mosquito source, preferred activity and resting area degree of protection from wind and the proximity to artificial background light. Studies have shown that light trap collections can vary significantly with only a 2 to 3 meter change in location.

The actual distance that a mosquito becomes attracted to a light source is unknown but it is thought to be very short and probably varies by species. The affect of background light on light traps is similar to that of moonlight in that it alters the contrast of the trap light as the attraction stimulus. Each of these factors shows that location of the light trap has considerable influence on trap data when comparing species composition, trap to trap collections, and year to year comparisons of individual traps.

Factors Affecting Variability in Light Trap Collections: **N**ot all mosquito species are attracted to or collected by New Jersey light traps (see Table below). There is considerable variation in the relative attractiveness of different mosquito species to light. Generally, light traps do not reflect the abundance or presence of species that are negatively phototaxic or only active during the day. In addition, mosquito species that inhabit wooded areas are less attracted to light traps then those, which prefer open areas.

Table. Mosquito species that can and cannot be accurately monitored by the New Jersey Light Trap.

Can be Accurately Monitored:

Ae. solicitans
Ae. vexans
Ae. taeniorhynchus
Cx. pipiens
Cx. salinarius
An. bradleyi
Cq. perturbans
Ps. columbiae

Cannot be Accurately Monitored:

Ae. canadensis
Ae. stimulans
Ae. triseriatus
Ae. excrucians
Ae. albopictus
Ae. aegypti
Cx. restuans
Cx. territans
An. punctipennis
An. quadrimaculatus
Cs. melanura
Ps. ferox

Although many different types of light bulbs have been tried in the New Jersey light trap, the clear 25-watt bulb is most widely used. For consistency and historic accuracy, this should continue to be the bulb of choice.

Whenever possible, light traps should be placed in the same location year after year for general surveillance practices. For greater accuracy in measuring population changes, newly installed traps should be located where mosquito populations are high. When installing the trap, be mindful of exterior lighting such as spotlights, windows and exhaust vents. The trap should be placed in an open area, away from buildings, but close to trees and shrubs. Attempts should also be made to protect the traps from prevailing winds. Light traps should be installed so that the bottom of the roof is around 5 1/2 feet above the ground.

Although no significant variation has been shown between trap color and species attractiveness it is suggested that light traps be painted green to blend with their surroundings. More important to the exterior trap color is the color of the underside of the

roof, which is most commonly painted white. Changing this color will affect light intensity emitted by the trap and increase variability in sampling.

The recommended dates for operating the New Jersey light traps in the United States are from May 1st through the month of October. Early May collections need not be made as frequently as those during the remainder of the season. May collections, however, may be useful in showing the presence of early season mosquitoes, which would otherwise go undetected.

Climatic conditions vary considerably year to year in September and October, but trap collections at these times may help detect population increases during warm spells. Generally, light traps are operated 7 nights per week, but if light trap data is only used for comparing year-to-year fluctuations, operating the traps four nights per week will provide accurate information. During the active mosquito season, light trap collections should be made a minimum of three times per week. If light traps are an agency's sole source of adult surveillance, or if they are used as thresholds to determine pesticide applications, more frequent collections may be necessary.

The most critical element in using light traps to guide day-to-day operations is the speed and accuracy of mosquito identification. Specimens should be identified within 24 hrs of collection.

When trap collections are exceptionally high, the entire sample need not be identified. It is considered accurate to spread the collection on a grid and sub sample 1/4 of the collection as long as at least 100 mosquitoes are identified. Obviously, accuracy in identification is critical to help determine the source of the mosquitoes and an appropriate control strategy.

Males in the collection may provide useful information. For some species, males can be a reliable indicator for the later emergence of females. Keep in mind that the factors which create variability in female mosquito behavior quite often influence males of the same species differently. Use of timers and electric eyes to operate light traps is very common. While there has been no significant difference shown on their effect on light trap collections, traps will run at different times depending on which device is used. For consistency, it is suggested that agencies use either all timers or all electric eyes. To assure consistency, timers should be calibrated at least every other year.

Procedure for Using the New Jersey Light Trap: The following procedures are presented to improve the reliability of light trap usage in mosquito surveillance programs and encourage uniformity of light trap data.

1. Do not rely on the New Jersey light trap as a reliable indicator for all species. There is considerable variation in the relative attractiveness of different mosquitoes to light and evaluate your light trap data accordingly.

2. Use a clear 25-watt bulb in the trap to make your data comparable with that of other mosquito control agencies.

3. Whenever possible, place the light traps in the same location year after year.

4. Be mindful of exterior lighting when installing a light trap and try to place the trap in open areas, away from buildings at a height of 5 1/2 ft above the ground.

5. Paint the exterior of the trap green and the underside of the roof white.

6. Begin trapping May 1 of each year and continue the trapping program through the month of October. Operate the traps 2-3 nights per week unless the information is only to be used to compare year-to-year fluctuations.

7. Whenever possible, identify the collections and analyze the data within 24 hours.

8. Males in the collection may give use information. A large number of male mosquitoes are an indication that a brood of females is about to emerge in that area.

9. For consistency, use either all timers or all electric eyes in the traps that make up your surveillance program.

10. Develop a system to manage your light trap data.

Conclusions: The New Jersey Light Trap has been and will continue to play an important role in mosquito control. Consistency of operation is the key to the reliability of New Jersey Light Trap use. When used consistently, New Jersey Light Traps are effective for monitoring population changes of some species, but because of species variability and the bias of trap location, the New Jersey Light Trap is generally not accurate for comparison of abundance between different mosquito species.